and of the influence that the distribution of rainfall and temperature in various parts of the country has on the character of the crop.

Then the cross-breeder's work begins: acclimatization alone is hardly likely to yield the ideal plant, but by it are found plants possessing the features, one here and one there, that are desiderated; and starting with this ground material the hybridizer can eventually turn out an individual possessing to a large measure all the qualities that are sought for.

There is little hope that science can do anything wholly new for agriculture; acclimatization, breeding and selection have been the mainstay of farming progress since the beginning of time, just as the action of the nitrifying bacteria and of nitrogen fixation by the leguminous plants was instinctively apprehended by the earliest farmers of whom we have any record.

But with increasing knowledge comes more power, and particularly the possibility of accelerating the rate of progress; agricultural improvements in the past have resulted from the gradual and unorganized accretions of the observation and experience of many men, often of many generations, now that we are provided by science with guiding hypotheses and by the organization of experiment with the means of replacing casual opinions by exact knowledge. Even the properties of the soil and the character of our farm crops and animals—stubborn facts as they are and deeply grounded in the nature of things—ought to become increasingly plastic in our hands.

A. D. HALL.

SCIENTIFIC BOOKS.

Physiological Economy in Nutrition. By RUSSELL H. CHITTENDEN, Ph.D., LL.D., Sc.D. New York, F. A. Stokes Co. 1904.

This notable volume, the production of Professor Chittenden and his coworkers, of whom Professor Lafayette B. Mendel is the most prominent, finally dispels the tradition that a continued liberal allowance of proteid in a normal diet is a prerequisite for the maintenance of bodily vigor.

Professor Chittenden had suffered from persistent rheumatism of the knee joint and determined on a course of dieting which should largely reduce the proteid and calorific intake. The rheumatism disappeared and minor troubles such as 'sick-headaches' and bilious attacks no longer recurred periodically as before.

There was a greater appreciation of such food as was eaten: a keener appetite, and more acute taste seemed to be developed and a more thorough liking for simple foods.

During the first eight months of the dieting there was a loss of body weight equal to eight kilograms. Thereafter for nine months the body weight remained stationary.

Two months of the time were spent at an inland fishing resort, and during a part of this time a guide was dispensed with and the boat rowed by the writer frequently six to ten miles in a forenoon, sometimes against head winds (without breakfast) and with much greater freedom from fatigue and muscular soreness than in previous years on a fuller dietary.

During this latter period of nine months the nitrogen of the urine was determined daily. The average was 5.69 grams. During the last two months this was reduced to 5.40 grams. Experiments showed that about one gram of nitrogen was eliminated in the fæces, and that nitrogen equilibrium could be maintained with dietaries of low calorific value (1,613 and 1,549 calories) containing 6.40 and 5.86 grams of nitrogen. These figures correspond to diets containing 40 and 36.6 grams of proteid instead of 118 grams commended by Voit and honored by habit and tradition. The foods with the strongest flavors are meats.

Professor Chittenden believes that the large quantity of proteid in the ordinary diet is due to self-indulgence. He protests against such indulgence and believes that a futile strain is thereby placed upon the liver, kidneys and other organs concerned in the transformation and elimination of the end products of proteid metabolism.

These experiments, however, were not confined to an individual or even to a single group of individuals. Similar experiments were made on other professional men, on student athletes in training, and on soldiers under military regimen. The nitrogen in the urine was determined daily in twenty-six individuals for periods extending from five to nine months.

Summarizing the results obtained in all these groups of individuals, it is established that a diet containing about fifty grams of proteid (8 grams of nitrogen) is able to maintain the adult body machine in perfect repair.

The professional group alleged a greater keenness for its work, the athletic group won championships in games, and the soldiers maintained perfect health and strength, many professing repugnance to meat when allowed it after five months of practical abstinence.

Although it is possible that the alleged improved mental condition may have been due to mental suggestion, still the fact remains that it has been absolutely proven by Chittenden's work that the allowance of proteid necessary for continued health and strength may be reduced for many months to one half or less what the habit of appetite suggests.

The reviewer would, however, remark that it still remains to be proven that the fifty grams of proteid in the diet—which is not greater than the body would metabolize in starvation—is advisable as a program for the whole of one's adult life. It may also be that more than this quantity is indicated, during convalescence from wasting disease, or during the muscular hypertrophy which accompanies preliminary training for muscular effort.

The reviewer believes that Professor Chittenden has fallen into error in the commendation of 2,500 to 2,600 calories as an ample energy content for the diet of a soldier at drill. Accurate information on this point is only obtainable through respiration experiments. Chittenden, pursuing a sedentary life, prescribes 2,000 calories for himself or 35 calories per kilogram of body weight, while Mendel requires 2,448 calories or 35.3 calories per kilogram. These are entirely normal values for people at light work. In the earliest calculations of Voit in 1866 it was shown that a man of 70 kilograms on a medium mixed diet produced 2,400 calories, or 34.3 calories per kilogram. Rubner allows 2,445 calories to men of 70 kilograms weight engaged in occupations involving light muscular work, men such as writers, draughtsmen, tailors, physicians, etc.

But the soldiers under Chittenden exercised for two hours in the gymnasium, then apparently drilled for one hour, and walked for another hour. This physical work can only be accomplished at the expense of increased metabolism. Zuntz has shown that to walk 2.7 miles in one hour along a level road requires an extra metabolism equivalent to the liberation of 159.2 calories in a well-trained man weighing 70 kilograms. If a soldier during four hours of exercise actually accomplished the equivalent of work of a walk of ten miles over and above what Professor Mendel accomplished in his laboratory, then the metabolism of the soldier would be larger than Professor Mendel's by 637 calories (159.2×4) or he would have had a total metabolism of 3,085 calories ($2,448 + 637$). This does not seem an improbable amount.

For ordinary laborers working eight to ten hours a day, such as mechanics, porters, joiners, soldiers in garrison and farmers, 3,000 calories, as advocated by Voit, is apparently not too great. Rubner's diet for the same class calls for 2,868 calories. Chittenden's allowance of 2,500–2,600 seems to the writer too small, while Atwater's of 3,400 appears excessive.

Unstinted praise for painstaking endeavor and unremitting toil belongs to the workers who have achieved this volume. It is a monument of fidelity and an inspiration to thoroughness in scientific work.

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The Insulation of Electric Machines. TURNER and HOBART. Pp. vi + 297. 146 illustrations. New York, The Macmillan Company. 1905. Price, $4.50.

It is a difficult and tedious task to write a